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The Evolutionary Significance of Reversionary Aberrations in the Bullfinch, *Pyrrhula pyrrhula* Linnaeus

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Even at a cursory glance one may observe abnormalities in the plumage of the bullfinch which deserve a thorough investigation. These aberrations are of colour, pattern and the relative size of the rectrices and remiges. I must emphasise that these aberrations may be arranged in groups. This may be expressed more exactly by saying that certain colour and pattern deviations are associated with differences in the relative length of the wing and tail feathers. Considerations like these lead me to the conclusion that these aberrations or variants have an atavistic or reversionary significance and provide data of the phylogeny of the species.

The starting point in the sequence of ideas for the verification of this assumption is the indisputable fact that if aberrations occur in a species, of a type which are found as normal characters in another species of the same genus, then the aberration denotes a relationship between the two species, either by indicating that they descended from a common ancestor, or that the progenitor of the species displaying this aberration is the one which possesses it as a normal character.

After this outline of the principle, I will give the data of the aberrant specimens. I examined a total of 66 birds; 36 males and 30 females. Aberrant specimens occurred only in the males. Of these 33 were of the nominate form, one of the race *P. p. europea* Vieillot, one of the race *P. p. rossikowi* Derjugin and Bianchi and one of the race *P. p. cineracea* Cabot. Of the 33 birds of the nominate race, 32 originated from Hungary, collected between 1957–60 and one was from the vicinity of Voronesh, U.S.S.R. The aberrant specimens were all nominate birds from Hungary as follows:—

1/59.1595.1	Csomád, near Budapest, 22.XI.1958.
2/59.1593.1	Alsógöd, near Budapest, 15.II.1959.
3/60.93.1	Adony, Transdanubia, 2.XII.1959.
4/60.151.1	Gyöngyös, Mátra Mts. 6.XII.1959.
5/60.152.1	Budapest, 26.XII.1959.
6/60.87.1	Szentendre, in Pilis Mts. 27.XII.1959.
7/60.153.1	Diósjenö, Börzsöny Mts. 19.I.1960.
8/59.1599.1	Szigetmonostor, near Bp. 8.II.1959.
9/60.91.1	Adony, Transdanubia, 12.XI.1959.
10/60.154.1	Szigetmonostor, near Bp. 10.I.1960.
11/59.1594.1	Budapest. 1.II.1959.
12/60.97.1	Budapest. 9.I.1960.
13/60.155.1	Diósjenö, Börzsöny Mts. 20.I.1960.
14/60.156.1	Diósjenö, Börzsöny Mts. 21.I.1960.

A detailed examination of these aberrant specimens demonstrates that the variations occurring in colour, pattern and the relative lengths of the remiges and rectrices can be divided into six groups.

In the first group, the tail is slightly forked, the middle rectrices are 2–3 mm. shorter than the outer ones and there are several reddish feathers in the blue-black plumage of the crown. Three specimens (1, 2 and 5) belong to this group.

The second group is represented by a specimen with a strongly forked tail, the middle rectrices are more than 5 mm. shorter than the outer ones and there are in the blue-black feathers of the crown, white feathers representing the discontinuous tracks of the white streak separating the black forehead from the blue-black crown, with also numerous pale grey and several reddish feathers intermingled with the blue-black ones of the crown (3). This one is illustrated in the accompanying plate.

Aberrant specimen No. 3 showing pale feathers in the crown and the strongly forked tail.

Of the two specimens placed in the third group of aberrations, one has a square tail as in normal birds, but there are about five orange-red feathers in the blue-black crown, while the other has a slightly forked tail, but a normally coloured crown; moreover there is a striking orange-red discolouration on the greater wing-coverts and in the grey colour on both sides and on the lower part of the back of both specimens (4, 13).

There are two further birds which show the aberrations of the first group, but in addition have some black feathers appearing in the dividing line of the white rump and the grey back (6, 7). These represent the fourth group.

In the fifth group there are four birds with black feathers above the white rump; thus this character is common with that of the specimens constituting the former group (8, 9, 10, 14).

In the sixth group of aberrant individuals the variation may be minimal from the normal characters of the bullfinch, the only deviation being that of a slightly forked tail (11.12).

As can be seen from this description of the fourteen aberrant specimens No. 3 shows the greatest departure from normal. In addition to the enumerated characteristics, there is yet another striking feature exhibited in the plumage of the specimen, namely, while in all bullfinches including normal as well as aberrant specimens, the second primary is equal in length to the sixth, the longest feathers of the wing are the third, fourth and fifth primaries, all of about equal length, in this bird the second and fifth are equal and the tip of the wing is formed by the third and fourth primaries, which are equal in length.

The results of these findings lead to the following conclusions:— First, the aberrations occur in about 43% of male bullfinches, which indicates a high degree of plasticity of characters. This plasticity is attested as variation of a reversionary character and cannot be classed as colour aberrations due to albinism, melanism, erythrism, chlorochroism, etc. or as colour deviations due to hybridisation.

The following arguments will prove this assumption. Specimen No. 3 displays the most suggestive and the most numerous aberrant peculiarities. Namely, the white feathers behind the black forehead which represent a throwback to the whitish streak in this place in *P. erythaca* Blyth, and the pale grey feathers mingling with the blue-black ones of the crown also correspond to the plumage of the crown in this same species. The strongly forked tail and the shape of the wings also suggest a reversion towards *P. erythaca*. On the other hand the single reddish feathers appearing in the crown are referable to *P. erythrocephala* Vigors.

The group of aberrations represented by specimens Nos. 1, 2, 5, revert entirely towards *P. erythrocephala*. The reversionary features here consist of the red feathers among the blue-black ones of the crown and the slightly forked tail.

Specimens No. 4 and 13 show decided inclinations towards *P. aurantiaca* Gould, partly by the reddish-orange feathers occurring on the blue-black crown (4) and partly by the orange suffusion on the greater wing-coverts and the back. One may also consider as reversionary the colouration of the underparts which are more vivid than in normal specimens and of an orange hue. Specimen No. 4 does not appear to show reversionary trends either on colour or in the shape of its tail which is square to *erythaca* or *erythrocephala*, while specimen 13 on account of its slightly forked tail has some affinity with these forms.

The reversionary peculiarities of specimens 6 and 7 representing the fourth group, relate partly to the species *erythaca*, wherein the white rump is separated by a black streak from the grey colour of the back; also, the black feathers at the upper edge of the white rump confirm this. On the other hand characteristics of *erythrocephala* are revealed in the reddish feathers among the blue-black ones of the crown and also the tail is somewhat forked. Aberrant specimens Nos. 8, 9, 10, 14 show undoubted affinities to *erythaca*. The last two and also the least aberrant birds (11 and 12) show in slight degree the forked tail of Asiatic specimens.

The presence of these characters demonstrates the fact that 12 of the

32 specimens of the nominate form *P. pyrrhula* show reversionary characters relating to the species *P. erythaca*, *erythrocephala* and *aurantiaca*. The presence of these reversionary features in this relatively high number of specimens in this explicit form provide evidence of decided and close relationship.

However, in the exposure and evaluation of the origin of these characters, we cannot rest content with the conclusion that the ancestors of *P. pyrrhula* are the three species *P. erythaca*, *erythrocephala* and *aurantiaca*, but we must go further and conclude that the last three species are also descended from each other or that, together with the species *P. pyrrhula*, they are derived from an earlier common ancestor or ancestors. This statement is supported by the fact that more than one specimen showed features common to two distinct species of the present time.

Six distinct species of bullfinch are generally accepted to-day; the present study investigating reversionary aberrations disclosed the close relationship of four of them. There remains the question of the degree of distinctness in the two remaining species. This will only be answered by further investigation, but this much is certain however, that the present studies provide some clues suggesting that these two species are also closely related to the four already mentioned. In *P. nipaleniss* Hodgson the upper half of the rump is black and the lower half white, which suggests the species *erythaca*. Although the crown is greyish-brown, the base of the feathers is blackish; the tail is forked, the innermost secondary reddish. These features are shared partly by *erythaca* and partly by *pyrrhula*. The colouration and pattern of *P. leucogenys* is also similar to that of the other species.

We must now add a few words on the red colour, the striking character of males of the bullfinch, *P. pyrrhula*. The red colour of the undersides of the male is absent in only the two southernmost species, namely *P. nipalensis* of the Malay Peninsula, and *P. leucogenys* of the Phillipine Islands. In two races of *P. pyrrhula*, namely *P. p. murina* Godmanson of the Azores and *P. p. cineracea* Cabot, south of lake Baikal, the red colour of the underparts is always absent, while it is only sometimes present in *P. p. griseiventris* Lafreynes ranging over the northern islands of Japan. There is much data attesting to the fact that the orange colour of the underparts of the male in *P. aurantiaca* is at times red. All this indicates that this character is still labile and consequently the red colour is unreliable as a specific character. However some authors regard *cineracea* as a species, but the variability of the red colour makes others hesitant in accepting this character as of specific value and therefore prefer to regard it as of racial value only.

The degree of variations is also rather wide not only as regards colour and pattern, but also in measurements and shape of the bill, which again indicates that these characters have not as yet become stabilized sufficiently to allow the drawing of sharp demarcating lines between the allopatric species of the bullfinch. In the present state of our knowledge and with reference to the results of the present reversionary studies, it seems best to designate the bullfinch at the present time as a superspecies. By this I mean that the species are rarely allopatric and are descended from a single species. In view of the fact that *P. pyrrhula* is a species which

ranges over an enormous area and which displays extremely variable characters of colour and measurement, it is readily understandable that this has lead to a large number of races being described, compared with the other five species with a much smaller range. Between 1758 and 1951, 31 races of *P. pyrrhula* were described as against only 6 races of the other five species, described between 1832 and 1921.

Partly on this account and partly on the basis of the reversions, we must look for the common ancestor among the other five species or in a still earlier form, closely related to one of them. Only a thorough study of the Asiatic species, including further investigation of their reversionary trends, will bring us nearer to the discovery of the common ancestor of the species.

In further support of this I might add that several biological features for instance the voice, are very similar among all the species in question. The soundness of these ideas is also supported by the fact that the number of aberrant specimens is high; furthermore they were collected over the course of three years (1958–60) and from widely separated localities. Moreover, the dates of collecting extend over four months from November to February. It is also clear from this that none of the aberrant specimens can be considered as a moulting abnormality, since this occurs only from August to October and in spring there is only an abrasion of the plumage, added to which all are adult and not first year specimens.

As a result of this investigation we can formulate the following rules. The higher the number, extent and intensity of reversionary aberrations in a given species, so much later did it separate from the one or more species to whose features it reverts. It follows that the incidence of reversionary aberrations is indicative of the age of the species.

It also follows that a decrease in reversionary aberrations indicates a stabilisation of the specific characters. If several characters of all species constituting a genus can be observed among the reversionary aberrations of one or other species, they denote that on the one hand the genus is of a homogenous origin and on the other hand, the species exhibiting the mixed reversionary aberrations is in a flourishing state of specialisation. An excellent example of such a species is *Pyrrhula pyrrhula* Linnaeus.

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